

ANCHOVY POWDER WITH REDUCED ARSENIC AND METHOD OF MAKING THE SAME

Field of the Invention

[0001] The present invention generally relates to baby food and its preparation, and more particularly to an anchovy powder with reduced arsenic concentration and a method of making the same.

Background of the Invention

[0002] Chronic arsenic exposure is of concern mainly because of its carcinogenic effects. Arsenic as a human carcinogen has been well documented from studies of skin, lung, and bladder cancers in people exposed to drinking water containing arsenic. See, e.g., Rossman, et al., Arsenite Cocarcinogenesis: an Animal Model Derived from Genetic Toxicology Studies, *Environmental Health Perspectives*, Volume 110, Supplement 5, p749-752 (2002).

[0003] Arsenic is a cumulative type of poison. Arsenic can be found in pesticides, laundry aids, tobacco smoke, smog, bone meal, dolomite, kelp, table salt, beer, seafood and drinking water. Symptoms of chronic arsenic poisoning include headache, confusion, drowsiness, convulsions and fingernail pigment changes.

[0004] For inorganic arsenic, the provisional tolerable weekly intake (PTWI) provided by WHO is 15 micrograms/kilogram of body weight/week. See, WHO. Evaluation of certain food additives and contaminants. In *33rd report of the Joint FAO/WHO Expert Committee on Food Additives*. WHO Technical Report Series 759; WHO: Geneva, Switzerland, 1989.

[0005] Anchovies are small silvery fish with blue-green backs. The major markets for consumption include Japan, United States, United Kingdom, Germany, France, Italy and Spain. Anchovy is one kind of recommended foods for the expected and nursing mothers and children in the growth period because of its abundant calcium and protein. It is especially true when the anchovy is eaten with bone in. For easy taking and digesting, the anchovy may be made into a dry powder. However, anchovies contain certain heavy

metals that may be harmful to a living object including human. The heavy metals include arsenic, copper, lead and cadmium.

[0006] Therefore, there is an imperative need to have anchovies and dry anchovy powders with reduced concentration of heavy metals so that they can be consumed safely. This invention satisfies this need by disclosing a dry anchovy powder and methods of making the same. Other advantages of this invention will be apparent with reference to the detailed description.

Summary of the Invention

[0007] The present invention provides a dry anchovy powder to be consumed by a living object wherein the powder has reduced concentration of heavy metals, especially arsenic. In addition, the present invention provides a method for reducing the concentration of heavy metals in anchovy prior to be consumed by a living object, wherein the method comprises of soaking and washing the anchovy in an aqueous solution including fresh water.

[0008] Accordingly, one object of the present invention is to provide a dry anchovy powder with reduced concentration of arsenic so that the anchovy powder can be consumed safely.

[0009] The objectives and advantages of the invention will become apparent from the following detailed description of preferred embodiments thereof.

Detailed Description of the Invention

[0010] The present invention may be understood more readily by reference to the following detailed description of certain embodiments of the invention.

[0011] Throughout this application, where publications are referenced, the disclosures of these publications are hereby incorporated by reference, in their entireties, into this application in order to more fully describe the state of art to which this invention pertains.

[0012] The inventor of the present invention has been seeking highly nutritious food/dietary supplement, especially for infants. Anchovy is one of the candidates

identified by the inventor of the present invention. As seen from the Table 2 below, anchovy is nutrition rich with a high concentration of calcium that is critical for bone growth and maintenance, especially for infants. However, as seen from the Table 1 below, anchovy contains arsenic in a concentration that is not suitable for consumption, especially by infants. In addition, current methods for reducing arsenic concentration in many different situations are not desirable because they introduce other harmful chemicals in the reduction process.

[0013] The inventor of the present invention discovered a simple way that can preserve the nutrition of anchovy and reduce the arsenic concentration in anchovy efficiently in a low cost. In preferred embodiments, the present invention provides a dry anchovy powder with reduced arsenic concentration and a method of making the anchovy powder. The process starts with semi-dried anchovies obtainable from general markets. The semi-dried anchovies are usually procured by drying under the Sun the fresh harvested anchovies without further process. The first step of making a dry anchovy powder is to pick and choose anchovies with good quality including size, appearance and freshness that are known to one skilled in the arts.

[0014] The second step of making a dry anchovy powder is to soak and wash the anchovies in fresh water. The ration of anchovies to water can be determined easily to suit for different anchovies. In one of the inventor's experiments, the ratio is one kilogram per three liters water. The water may be tap water. Moreover, the soaking and washing may be done in any aqueous solution that is free of any organic solution and heavy metals. The temperature of the soaking and washing solution may be easily determined by one skilled in the arts. Generally speaking, lower temperature is helpful in preserving the freshness of the anchovies during the process, especially in situations where the soaking and washing may take up more than twenty (20) hours. The soaking and washing may be done in many different ways. For example, one is disposed the water for soaking and washing in a container such a basket and a tank. The anchovies may be contained in a net bag and immersed in the water. Then, the water may be changed several times at different intervals. For increasing the diffusion, a water pump may be used to enhance the circulation of the water within the container. Another is to dispose the anchovies in a column so that the water can be running through the anchovies.

[0015] The third step of making a dry anchovy powder is to dry the anchovies in a heat-air system. At the end of soaking and washing, the anchovies may be spun in a spinning machine to get rid of the excess water. Then, the anchovies are roasted in an oven to their dry form. Usually, the moisture content within the anchovies is less than ten (10) percent.

[0016] The final step of making a dry anchovy powder is to grind the dry anchovies in the grinding machine into powder. The grinding systems and methods are well known in the arts. Thus, there is no detail provided as to drying and grinding system.

[0017] The present invention also contemplates that the anchovies with reduced arsenic concentrations may be consumed in ways other than as powder. For example, the anchovies may be served in their traditional dishes or as a component in composite food.

[0018] Examples

[0019] The following examples are offered by way of illustration and not by way of limitation.

[0020] Example 1

[0021] Semi-dried anchovies were obtained from the market. Typically, anchovies are dried under the solar heat immediately after being surfaced from the ocean. The semi-dried anchovies were selected for good quality ones for further process. Then, the semi-dried anchovies were soaked in tap water and washed by interval changes of water. The soaked and washed anchovies were dried by roasting in heat-air dry system and grinded into powder.

[0022] Table 1 summarizes the arsenic concentrations in dry anchovy powders made from the same batch semi-dried anchovies processed in different conditions. Sample 1 represents a dry anchovy powder that was made from semi-dried anchovies without going through any process other than grinding. Sample 2 represents a dry anchovy powder that was made from semi-dried anchovies that were roasted in the heat-air dry system and grinded into powder but without soaking and washing process. Sample 3 represents a dry anchovy powder that was made from semi-dried anchovies. The semi-dried anchovies in sample 3 were soaked in tap water (1kg/3liter). Then, the water was changed at 2, 5, 8, 23, and 25 hours from the start. Within two hours after the last change of water, the anchovies

were recovered from the soaking tank and the excess water was extracted by spinning for ten minutes. Then, the anchovies were roasted and grinded. Sample 4 represents a dry anchovy powder that was made from semi-dried anchovies. The semi-dried anchovies in sample 4 were soaked and washed in tap water in an identical manner of sample 3 except for that a water pump was placed in the water to circulate the water during the washing process. Sample 5 represents a dry anchovy powder that was made from semi-dried anchovies. The semi-dried anchovies were processed in an identical manner of sample 3 except for that the water was chilled to about 0.5 to 0.8°C.

[0023] Table 1. Summary of the heavy metal concentrations and moisture contents in dry anchovy powders.

# of sample	Arsenic (ppm)*	Mercury (ppm)*	Copper (ppm)*	Lead (ppm)*	Cadmium (ppm)*	Moisture content (%)^
1	1.81	<0.01	1.25	0.54	0.40	22.9
2	2.49	<0.01	1.89	0.51	0.61	7.6
3	1.17	<0.01	2.02	0.78	0.56	6.6
4	0.57	<0.01	1.90	1.01	0.42	5.5
5	1.68	<0.01	0.92	0.40	0.39	7.0

* The determination method is MF – 06 (Acid Digestion/ICP).

^ The determination method is MF – 04 (AOAC 934.01).

[0024] Example 2

[0025] One exemplary sample of the dry anchovy powder was analyzed for its nutritional components.

[0026] Table 2. Nutritional analysis data of one exemplary batch of anchovy powder of the present invention

Testing parameters	Methods	Results Per 100g
Phosphorus (mg)	Acid Digestion/ICP	1520
Magnesium (mg)	Acid Digestion/ICP	255
Selenium (mg)	Acid Digestion/ICP	0.90
Zinc (mg)	Acid Digestion/ICP	8.35
Potassium (mg)	Acid Digestion/ICP	466
Manganese (mg)	Acid Digestion/ICP	2.19
Crude protein (g)	Modified AOAC 17 th Ed 4.2.09	70.78

Crude fat (g)	Modified AOAC 17 th Ed 4.5.01	5.08
Carbohydrate (g)	By calculation	0.57
Energy (kcal)	By calculation	331.12
Vitamin A (As Retinol) (iu)	(In house method No. 3.2)HPLC	11.00
Vitamin B1 (as Thiamine) (mg)	HPLC	<0.05
Vitamin B2 (as Riboflavin) (mg)	HPLC	<0.05
Vitamin B3 (as Nictotinamide) (mg)	HPLC	1.89
Vitamin B5 (as Pantothenic Acid) (mg)	HPLC	4.53
Vitamin B6 (as Pyridoxine) (mg)	HPLC	<0.05
Vitamin B12 (as Cyanocobalamine) (ug)	HPLC	106.57
Vitamin D3 (as Cholecalciferol) (iu)	HPLC	901
Biotin (mg)	HPLC	21.95
Salt (mg)	Titration	2.56
Choline (mg)	Spectrometry	133.7
Calcium (mg)	AAS	3110.67
Iron (mg)	AAS	9.01
Fatty Acid	Gas Chromatography	
Linolenic Acid (g)	C18:3 W3	.051
Eicosapentaenoic Acid EPA (g)	C20:5 W3	0.215
Docosaheaxanoic Acid DHA (g)	C22:6 W3	0.856

[0027] Example 3

[0028] Semi-dry anchovies were soaked in tap water. The water was changed every three hours. After two changes of water, the anchovies were processed in accordance with the present invention. The semi-dry anchovies and dried anchovy powder were assayed for their contents of arsenic. The semi-dry anchovies had a concentration of arsenic about 3.6ppm. The dry anchovy powder had a concentration of arsenic about 1.7ppm. The results are summarized in Table 3.

[0029] Example 4

[0030] Semi-dry anchovies were soaked in tap water. The water was changed every two hours. After four changes of water, the anchovies were processed in accordance with the present invention. The semi-dry anchovies and dried anchovy powder were

assayed for their contents of arsenic. The semi-dry anchovies had a concentration of arsenic about 3.4ppm. The dry anchovy powder had a concentration of arsenic about 0.84ppm. The results are summarized in Table 3.

[0031] Table 3. Summaries of Arsenic concentrations in pre-washing semi-dry anchovies and post-washing dry anchovy powder

# of Example	Concentration of Arsenic in pre-washing semi-dry anchovies	Concentration of Arsenic in post-washing dry anchovy powder
1	3.6 ppm	1.7 ppm
2	3.4 ppm	0.84 ppm

[0032] This invention provides convenience of using, easiness of digestion with high absorption of calcium, various usability, reduction of environmental pollution with using all parts of anchovy, and maintenance of the original color and taste. Most importantly, the present invention provides an efficient and cost-effective method for reducing the arsenic concentration from anchovies.

[0033] While the present invention has been described with reference to particular embodiments, it will be understood that the embodiments are illustrative and that the invention scope is not so limited. Alternative embodiments of the present invention will become apparent to those having ordinary skill in the art to which the present invention pertains. Such alternate embodiments are considered to be encompassed within the spirit and scope of the present invention. Accordingly, the scope of the present invention is described by the appended claims and is supported by the foregoing description.